Enzymatic dyeing of wood

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Abstract

This study reports the "in situ" enzymatic dyeing of pinewood samples using a *Trametes villosa* laccase, in a batchwise process at low temperature and mild pH. Laccase (EC 1.10.3.2) is a multicopper oxidase, which reduces oxygen to water and simultaneously performs one-electron oxidation of many aromatic substrates such as phenols and aromatic amines. The resulting aryloxy radicals undergo further non-enzymatic reactions forming coloured dimeric, oligomeric and polymeric molecules. A series of colourless diamines, aminophenols, aminonaphtols dye precursors and phenols dye modifiers was performed in different combinations to obtained different hues and depth of shades in the color pallet. The concentration of the reactants and the duration of the enzymatic reaction appeared to be the most important factors in the dyeing process. Moreover the laccase ability in the delignification of the aromatic phenols in wood fibers revealed an important factor for the dye absorption on the wood samples. The break down of the ligno-cellulose molecules in the wood surface, increase the substantivity of the dye and provide an homogeneous absorbtion in the lignin matrix. The kinetics of the coupling reaction between a dye precursor and a modifier was also studied. The enzymatic dyeing could be an useful alternative at the tradicional dyeing of the wood providing an extense colour palette and an enviromental alternative for wood preservatives against rotting and deterioration.